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October 17, 2000

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of Corrado VEZZANI
METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES
Our Ref: Q61145

Dear Sir:

This is a request for a Continuation Application of pending prior Application No. 08/948,157 filed October 9, 1997 of Corrado VEZZANI entitled METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES.

This application is being filed under 37 C.F.R. § 1.53(b). Enclosed is a specification, including the claims, 1 sheet of drawings, a copy of the Verified Statement (Declaration) Claiming Small Entity Status as filed in the prior application, and a copy of the Revocation and Appointment of Attorneys as filed in the prior application (because the parent application was filed by another firm, the undersigned does not presently have a copy of the Declaration and Power of Attorney originally filed in that case; a copy of the Declaration and Power of Attorney will be filed after it is obtained by the undersigned). Also enclosed is an Information Disclosure Statement and a PTO Form 1449 listing references cited by applicant and/or the examiner during prosecution of the parent application.

A Preliminary Amendment is being submitted herewith.

Applicant respectfully requests an interview with the Examiner prior to examination of this application.

The prior application is assigned to Group Art Unit 1764.

The Government filing fee is calculated as follows (**Small Entity fees apply**):

Total claims	4	- 20	=		x	$9.00	= $.00
Independent claims	1	- 3	=		x	$40.00	= $.00
Base Fee							$355.00
TOTAL FILING FEE							**$355.00**

A check for the statutory fee of $355.00 is attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The

Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

The application is timely filed.

Respectfully submitted,
SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
Attorneys for Applicant

By: Bruce E. Kramer

Bruce E. Kramer
Registration No. 33,725 ***for***
Robert V. Sloan
Registration No. 22,775

Applicant or Patentee: 39 02 57510909 S.r.l. Attorney's

Serial or Patent No.: 08/948,152. Docket No.:

Filed or Issued: October 9, 1997

For: "Method for the concentration of liquid mixtures"

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) — SMALL BUSINESS CONCERN

I hereby declare that I am

( ) the owner of the small business concern identified below;
(X) an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN VOMM CHEMIPHARMA S.r.l.

ADDRESS OF CONCERN Via Dante, 16 - 20121 MILANO - ITALY

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES. by inventor(s)

CORRADO VEZZANI

described in

( ) the specification filed herewith
(X) application serial no. 08/948,152, filed October 9, 1997.
( ) patent no. , issued .

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME

ADDRESS

( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

NAME

ADDRESS

( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Giuseppina CEREA

TITLE OF PERSON OTHER THAN OWNER Sole Director

ADDRESS OF PERSON SIGNING Via Verri, 2 - 20090 TREZZANO S/N/ - MILANO - ITALY

SIGNATURE

DATE October 31, 1997

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

VEZZANI, CORRADO

Appln. No.: Continuation of Appln. No. 08/948,157 Group Art Unit: 1764 [In Parent]

Filed: October 17, 2000 Examiner: F. Varcoe, Jr. [In Parent]

For: METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Amend the specification by inserting before the first line the sentence:

--This is a Continuation of Application No. 08/948,157 filed October 9, 1997, the disclosure of which is incorporated herein by reference.--

On page 6, prior to the heading "DETAILED DESCRIPTION OF THE INVENTION", please insert:

--BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 is a cutaway side view of the present invention showing a turbo-concentrator having a cylindrical tubular body closed at opposite ends and provided with a coaxial heating jacket through which a fluid flows.--

IN THE CLAIMS:

Please cancel claims 1-5.

Please add the following new claims:

--Claim 6. A method for the concentration of liquid mixtures, comprising the steps of:

feeding a continuous stream of a liquid mixture into a turbo-concentrator comprising a cylindrical tubular body which has an internal wall, a horizontal axis and which is equipped with an opening for an introduction of the liquid mixture and with an opening for the discharge of a final product, a heating jacket for heating said internal wall of said tubular body to a predetermined temperature, and a bladed rotor rotatably supported in said cylindrical tubular body where said bladed rotor is rotated at circumferential speeds variable from 30 to 50 m/s,

centrifuging the liquid mixture to form a dynamic and tubular thin layer in which the liquid mixture is maintained in a state of turbulence by the blades of said bladed rotor,

advancing said dynamic and tubular thin layer to said discharge opening of the turbo-concentrator, causing said dynamic and tubular thin layer to flow substantially in contact with said heated internal wall to the discharge opening, and

discharging continuously a stream of a concentrated liquid mixture.

Claim 7. The method according to Claim 6, wherein a stream of a gas is fed into the turbo-concentrator such that the continuous stream of liquid mixture and gas flow in the same direction along a longitudinal axis of the turbo-concentrator.

Claim 8. The method according to Claim 6, wherein at least a portion of the continuous stream of concentrated liquid mixture leaving the turbo-concentrator is recycled to the turbo-concentrator.

Claim 9. The method according to Claim 7, wherein a portion of the continuous stream of concentrated liquid mixture leaving the turbo-concentrator is fed in again continuously upstream of the turbo-concentrator. --

REMARKS

The above amendment places the claims in the condition they were in on appeal in the parent application. In addition, the specification has been amended to include a cross-reference to the parent application and to make a change made in the parent application. Entry and consideration of this amendment is respectfully requested.

Applicant respectfully requests an interview with the Examiner prior to examination of the above-identified application.

Respectfully submitted,

Bruce E. Kramer
Registration No. 33,725 ***for***
Robert V. Sloan
Registration No. 22,775

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Date: October 17, 2000

METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES

DESCRIPTION

FIELD OF THE INVENTION

The present invention relates, in its more general aspect, to the concentration of substantially liquid mixtures and solutions.

More especially, the invention relates to a method for the industrial concentration of substantially liquid mixtures and solutions within all industrial sectors, such as, for example, the food sector, and in the disposal of urban refuse, in purification plants, and in the recovery of heavy metals contained in aqueous solutions, etc..

Purely for the sake of simplicity, these substantially liquid mixtures and solutions will be referred to in the course of the description as liquid mixtures.

BACKGROUND OF THE INVENTION

The apparatuses chiefly used for the concentration of liquid mixtures include multiple-effect concentrators and vacuum concentrators.

The first type of technology comprises a series arrangement of two or more concentrators each comprising a container filled with the mixture to be concentrated, a coil heating device which is immersed in the liquid mixture and which is generally fed with steam, and finally a pipe system which connects in series the two or more containers constituting the plant. The liquid mixture in the first container is heated and concentrated by means of mains steam. After having reached a specific degree of concentration, the liquid mixture is conveyed into the next container where it is subjected to an analogous treatment, the only difference being that, in this case, the mains steam is replaced by the vapour coming from the first container, or that released from the liquid mixture in the first concentration stage. The process just described can be repeated several times until the desired concentration is obtained.

With this type of technology, however, it is possible to reach only a specific degree of concentration, which is determined by the viscosity of the product to be treated, because it is necessary to ensure that the product, which becomes gradually more dense, runs well from one container to another in the concentration plant in order to avoid undesired obstructions in the connecting pipe

system. This problem is further aggravated if the liquid mixture to be treated contains various types of fibre, or aggregates of insoluble salts or the like. A further disadvantage presented by any type of liquid mixture to be treated, however, is that of the encrustations which form on the heating coils which have to be dismounted and cleaned periodically.

The second type of apparatus, the vacuum concentrators, normally comprise a container heated by a jacket or a heating coil, the latter being immersed in the liquid mixture to be treated, and a condenser for condensing the vapour formed in the concentration stage.

This type of apparatus, however, has the disadvantage of operating batchwise which, as is well known, limits productivity and requires more complex management operations. Added to this are the above-mentioned problems of the encrustations on the coils or other parts of the plant, and also a considerable waste of energy owing to the maintenance of reduced pressure in the plant.

SUMMARY OF THE INVENTION

The problem underlying the invention is to provide a method for the concentration of liquid mixtures of

various kinds which avoids all the above-mentioned disadvantages.

The problem is solved, in accordance with the invention, by a method for the concentration of liquid mixtures, comprising the stage of causing a continuous stream of the liquid mixtures to flow in the form of a dynamic turbulent thin layer in contact with a heated wall.

The use of dynamic turbulent thin layers in contact with a heated wall has been found to be especially advantageous because it involves the formation of a large exchange surface, which substantially accelerates the processes of transporting mass and energy. Therefore, the use of thin layers enables the dimensions of the entire plant to be substantially reduced and the energy costs to be considerably decreased.

In a preferred embodiment of the present invention, a turbo-concentrator is used as the concentration unit. Of the machines of this type, that produced and marketed by the company VOMM-IMPIANTI E PROCESSI of Milan (Italy) has been found to be especially useful and advantageous. This machine basically comprises a cylindrical tubular body, having a horizontal axis and closed at the opposite ends,

which is provided with openings for the introduction of a liquid mixture to be treated and a stream of dry air travelling in the same direction, a heating jacket for heating the internal wall of the tubular body to a predetermined temperature, and a bladed rotor rotatably supported in the cylindrical tubular body where it is rotated at a circumferential speed variable from 30 to 50 m/s.

With the use of a turbo-concentrator of the above-mentioned type, the method of the invention is characterised in that it comprises the stages of:

- feeding a continuous stream of liquid mixture into the turbo-concentrator in which the bladed rotor is rotated at circumferential speeds variable from 30 to 50 m/s,
- centrifuging the liquid mixture to form a dynamic and tubular thin layer in which the liquid mixture is maintained in a state of high turbulence by the blades of the bladed rotor,
- advancing the dynamic and tubular thin layer to the discharge opening of the turbo-concentrator, causing it to flow substantially in contact with the heated wall of the latter to the discharge opening,
- discharging continuously a stream of concentrated liquid mixture.

The use of the method just described, because it is continuous, permits much higher productivity than do the batch or semi-batch techniques of the prior art. The use of an apparatus like that described above also substantially reduces the problems associated with the maintenance and the cleaning of the plant and thus the general management and production costs.

Advantageously, a stream of hot dry air is fed into the turbo-concentrator in the same direction as the stream of liquid mixture; thus, the speed at which vapour is removed is increased, which further reduces the residence times necessary for the stream in the concentration unit.

The above-mentioned stream of dry air preferably has a flow rate which may be up to 6 Nm^3 of air per litre of evaporated water.

A further embodiment of the invention provides, where appropriate, for the recycling of a portion of the discharged concentrated stream upstream of the turbo-concentrator; this increases the viscosity of the incoming stream, which facilitates the operation of the concentrator.

DETAILED DESCRIPTION OF THE INVENTION

The characteristics and advantages of the invention will become clear from the following description of embodiments of the method described above which is given with reference to an apparatus shown diagrammatically in the single appended drawing, which is provided purely by way of illustration.

Referring to the above-mentioned drawing, an apparatus used for the method of concentration according to the invention comprises a turbo-concentrator formed basically by a cylindrical tubular body 1 which is closed at the opposite ends by bases 2, 3 and which is provided coaxially with a heating jacket 4 through which a fluid, for example diathermic oil, is to flow in order to maintain the internal wall of the body 1 at a predetermined temperature.

The tubular body 1 is provided with an opening 5 for the entry of the liquid mixture to be concentrated, an opening 6 for the stream of hot dry air, and also an opening 7 for the discharge of the concentrated liquid mixture.

A bladed rotor 8, the blades 9 of which are arranged helically and are orientated to centrifuge and simultaneously convey to the outlet the liquid

mixture to be concentrated, is rotatably supported in the tubular body 1.

A motor M is provided to operate the bladed rotor at variable speeds.

EXAMPLE 1

A 35% solution of acetylated starch in acetic acid having a degree of acetylation equal to saturation was fed continuously into the turbo-concentrator described above at a flow rate of 100 kg/h. The internal wall of the turbo-concentrator was maintained at a temperature of 130°C. The bladed rotor, rotating at a circumferential speed of 40 m/s, centrifuged the liquid mixture against the wall of the turbo-concentrator where it formed a dynamic and turbulent tubular thin layer. After a residence time of 30 seconds, the stream of solution leaving the turbo-concentrator 1 was conveyed into a suitable storage unit (not shown). The solution so obtained had a concentration of 80%.

EXAMPLE 2

A solution of polypropylene carbonate in methylene chloride, having a solids content of 20%, was fed continuously at a flow rate of 100 kg/h into the

turbo-concentrator described above, in the same direction as a stream of hot dry air having a flow rate of 500 m^3/h. The temperature of the internal wall of the turbo-concentrator was 120°C, the circumferential speed of the bladed rotor was 40 m/s and the residence time in the turbo-concentrator was 1 minute. The stream leaving the turbo-concentrator, having a 90% solids content, was then discharged in the form of a molten mass and conveyed to a suitable storage unit.

EXAMPLE 3

A 75% solution of sorbitol in water was fed into the turbo-concentrator at a flow rate of 100 kg/h. The temperature of the internal wall of the turbo-concentrator 1 was 140°C, the circumferential speed of the bladed rotor was 40 m/s, while the residence time in the turbo-concentrator 1 was 2 minutes. The concentrated stream leaving the turbo-concentrator exhibited a 99% solids content.

EXAMPLE 4

A saline solution of dump effluent as such or coming from a membrane concentration plant with an average solids content of 2% was fed into the turbo-concentrator at a flow rate of 1000 kg/h. The

temperature of the internal wall of the turbo-concentrator 1 was 240°C, the circumferential speed of the bladed rotor was 40 m/s, while the residence time in the turbo-concentrator 1 was 2 minutes. The concentrated stream leaving the turbo-concentrator exhibited a 50% solids content.

I claim:

1. A method for the concentration of liquid mixtures, comprising the step of causing a continuous stream of the liquid mixtures to flow in the form of a turbulent thin layer in contact with a heated wall.

2. A method for the concentration of liquid mixtures, comprising the steps of:

- feeding a continuous stream of a liquid mixture into a turbo-concentrator comprising a cylindrical tubular body (1) which has a horizontal axis and which is equipped with an opening (5) for the introduction of the liquid mixture and with an opening (7) for the discharge of the final product, a heating jacket (4) for heating the internal wall of the tubular body to a predetermined temperature, and a bladed rotor (8) rotatably supported in the cylindrical tubular body (1) where it is rotated at circumferential speeds variable from 30 to 50 m/s,
- centrifuging the liquid mixture to form a dynamic and tubular thin layer in which the liquid mixture is maintained in a state of high turbulence by the blades (9) of the bladed rotor (8),
- advancing the dynamic tubular thin layer to the discharge opening (7) of the turbo-concentrator,

causing it to flow substantially in contact with the heated wall of the latter to the discharge opening,

- discharging continuously a stream of concentrated liquid mixture.

3. A method according to Claim 2, wherein a stream of hot dry air is fed into the turbo-concentrator in the same direction as the continuous stream of liquid mixture.

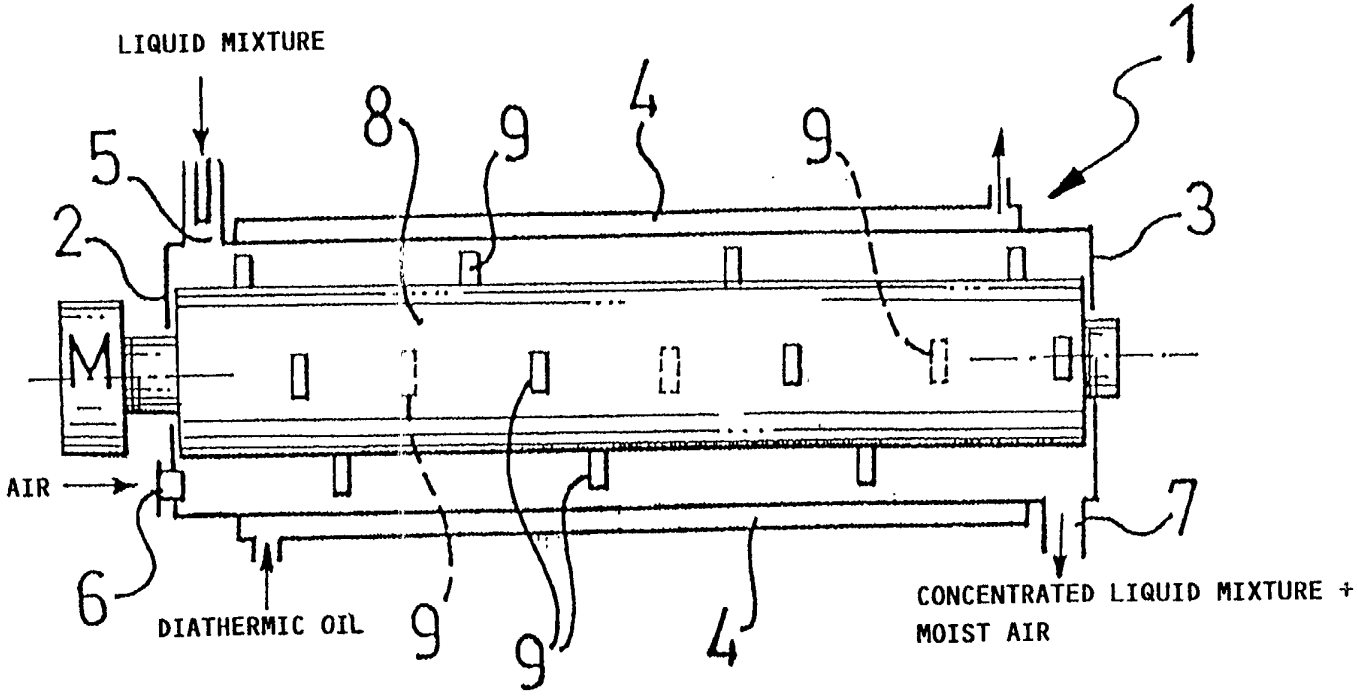
4. A method according to Claim 2, wherein a portion of the continuous stream of concentrated liquid mixture leaving the turbo-concentrator is fed in again continuously upstream of the turbo-concentrator.

5. A method according to Claim 3, wherein a portion of the continuous stream of concentrated liquid mixture leaving the turbo-concentrator is fed in again continuously upstream of the turbo-concentrator.

METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES

ABSTRACT OF THE DISCLOSURE

A method for the concentration of liquid mixtures, comprising the step of causing a continuous stream of the liquid mixtures to flow in the form of a turbulent thin layer in contact with a heated wall; for that purpose, a continuous stream of liquid mixture is fed into a turbo-concentrator comprising a cylindrical tubular body (1), a heating jacket (4) and a bladed rotor (8) rotatably supported in the cylindrical tubular body (1), and is centrifuged to form a dynamic and tubular thin layer, the thin layer advancing inside the cylindrical tubular body (1) then being discharged continuously in the form of a stream of concentrated liquid mixture.



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Corrado VEZZANI

Appl. No. 08/948,157 Group Art Unit: 1764

Filed: October 9, 1997 Examiner: J. Kennedy

For: METHOD FOR THE CONCENTRATION OF LIQUID MIXTURES

REVOCATION AND APPOINTMENT OF ATTORNEYS

DEC - 8 1999

Honorable Assistant Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

I. Corrado VEZZANI, the inventor of the present application hereby revokes all prior powers of attorney and appoints John H. Mion, Reg. No. 18,879, Thomas J. Macpeak, Reg. No. 19,292, Robert J. Seas, Jr., Reg. No. 21,092, Darryl Mexic, Reg. No. 23,063, Robert V. Sloan, Reg. No. 22,775, Peter D. Olexy, Reg. No. 24,513, J. Frank Osha, Reg. No. 24,625, Waddell A. Biggart, Reg. No. 24,861, Louis Gubinsky, Reg. No. 24,835, Neil B. Siegel, Reg. No. 25,200, David J. Cushing, Reg. No. 28,703, John R. Inge, Reg. No. 25,916, Joseph J. Ruch, Jr., Reg. No. 26,577, Sheldon I. Landsman, Reg. No. 25,430, Richard C. Turner, Reg. No. 29,710, Howard L. Bernstein, Reg. No. 25,665, Alan J. Kasper, Reg. No. 25,426, Kenneth J. Burchfiel, Reg. No. 31,333, Gordon Kit, Reg. No. 30,764, Susan J. Mack, Reg. No. 30,951, Frank L. Bernstein, Reg. No. 31,484, Mark Boland, Reg. No. 32,197, William H. Mandir, Reg. No. 32,156, Brian W. Hannon, Reg. No. 32,778, Abraham J. Rosner, Reg. NO. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils,

Reg. No. 33,102; Brett S. Sylvester, Reg. No. 32,765, Robert M. Masters, Reg. No. 35,603 and George F. Lehnigk, Reg. No. 36,359 as his attorneys to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and requests that all correspondence about the application be addressed to:

SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3202
Phone: (202) 293-7060

Respectfully submitted,

Date: ROZZANO, 15th November 1999

Name: CORRADO VEZZANI